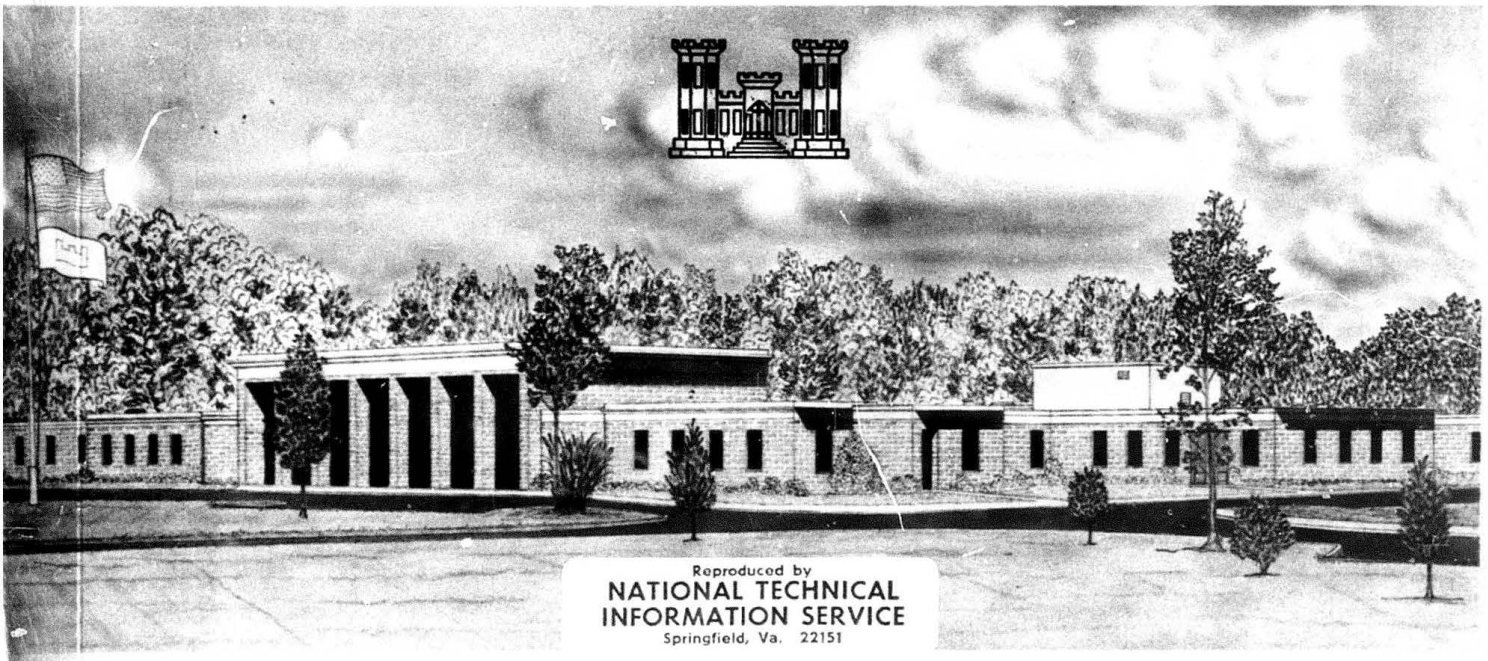
MISCELLANEOUS PAPER S-71-11

CONDITION SURVEY, LIBBY ARMY AIRFIELD FT. HUACHUCA, ARIZONA

by

P. J. Vedros



April 1971

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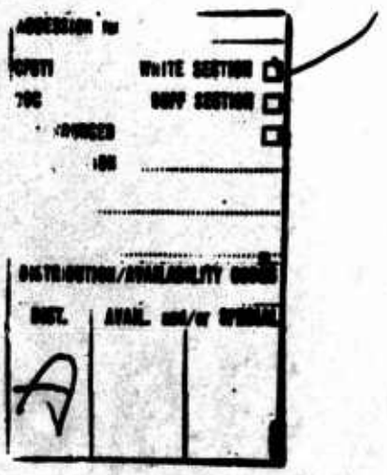

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ARMY-MRC VICKSBURG, MISS.

Foreword

Authority for performance of condition surveys at selected airfields is contained in Long Range Program, O&MA, FY 1971, Project Q6-1: "Engineering Criteria for Design and Construction - WES," dated May 1970.

The facilities at Libby Army Airfield were inspected in September 1970 by Messrs. P. J. Vedros and A. H. Joseph of the Flexible Pavement Branch, U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss. This report was prepared by Mr. Vedros under the general supervision of Messrs. J. P. Sale, R. G. Ahlvin, and R. L. Hutchinson of the Soils Division, WES.

COL Ernest D. Peixotto, CE, was Director of the WES during the conduct of the study and preparation of the report. Mr. F. R. Brown was Technical Director.

Contents

Conversion Factors, British to Metric Units of Measurement

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
feet	0.3048	meters
miles (U. S. statute)	1.609344	kilometers
square yards	0.836127	square meters
gallons	3.78543	cubic decimeters
pounds	0.45359237	kilograms
pounds per square inch	0.070307	kilograms per square centimeter
pounds per cubic foot	16.0185	kilograms per cubic meter

CONDITION SURVEY
LIBBY ARMY AIRFIELD, FT. HUACHUCA, ARIZONA

Purpose

1. The purpose of this report is to present the results of an investigation performed at Libby Army Airfield (LAAF) in September 1970. The inspection was limited to visual observations, and no tests were conducted on the existing runways and taxiways. A layout of the airfield is shown in plate 1.

Pertinent Background Data

2. LAAF is located on the reservation of Ft. Huachuca, Arizona, adjacent to State Highway 92, approximately 35 miles* northwest of Bisbee, Arizona. Ft. Huachuca is in southwestern Cochise County, Arizona. The reservation extends from the crest of the Huachuca Mountains (elev 8406 ft msl) to the San Pedro River (approximate elev 3700 ft). The Huachuca Mountains are composed of limestone, sandstone, shale, quartzite, granite, quartz monzonite, and volcanics, ranging in age from early Cambrian to late Cretaceous. Numerous quartz dikes cut across all other rock types. Bedrock near the inhabited area of the Post is quartzite and quartz monzonite, both very hard. Most of the Post installations are built on coalesced alluvial fans sloping northeast to the San Pedro River. The fanglomerate consists of gravel, cobbles, and boulders in a matrix of red sandy clay or clayey sand. The deposits are well compacted and partially cemented by caliche. Graded deposits occur only in old stream channels and form a small percentage of the entire deposits. Quartzite, quartz monzonite, sandstone, and agate are the predominant rock materials in the fanglomerate. The soils in the airfield area classify as poorly graded clayey gravelly sands.

3. In September 1970, the airfield facilities consisted of a primary runway (NW-SE) 5365 ft long and 100 ft wide, a crosswind runway (NE-SW) 4300 ft long and 75 ft wide, connecting taxiways, and a parking apron.

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* A table of factors for converting British units of measurement to metric units is presented on page vii.

A portion of the original E-W runway was still in existence and being used as a parking area. A taxiway connects the security area to the other facilities (see plate 1).

Previous reports

4. Previous reports relative to LAAF are as follows:

   a. Condition survey. No previous condition surveys have been made at LAAF.

   b. Evaluation. One evaluation report has been prepared for the pavements at LAAF: "Army Airfield Pavement Evaluation, Libby Army Airfield, Fort Huachuca, Arizona," Technical Report No. 3-466, Report 11, dated January 1959, prepared by U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

   c. Other reports.

      (1) "Materials Investigation Report for Concrete Apron at Libby Field, Fort Huachuca, Arizona," dated March 1956, prepared by U. S. Army Engineer District, Los Angeles.

      (2) "Basis for Design, Runways and Taxiways," Line Items 71 and 87, Design Job No. 7222, dated 20 January 1961, by U. S. Army Engineer District, Los Angeles.

      (3) "Materials Investigation Report for Taxiway Rehabilitation at Libby Field, Fort Huachuca, Arizona," dated March 1967, by U. S. Army Engineer District, Los Angeles.

Pertinent data have been extracted from these reports and used herein.

Construction history

5. Original construction. The original construction was accomplished as a training program by an Aviation Engineer Battalion in 1952. A portland cement concrete parking apron and bituminous-surfaced E-W runway and taxiway were constructed at this time. Detailed records were not available for this construction.

6. 1957 construction. In 1957 the parking apron was extended to the east. This construction consisted of 8 in. of portland cement concrete on a compacted subgrade. The design specified that the pavement on the extension have a load-carrying capacity comparable to that of the existing apron, which was evaluated at that time for single-wheel aircraft loads of 21,000 lb having a 100-psi tire pressure and 15,000 lb having a 200-psi tire pressure.

7. 1961 construction. In 1961 a primary runway 5365 ft long and 100 ft wide, a crosswind runway 4300 ft long and 75 ft wide, connecting taxiways from

the apron to the runways, and a connecting taxiway to the security area were constructed (as shown in plate 1). A portion of the east connecting taxiway to the primary runway utilized a 50-ft-wide area of the existing runway. The pavements were designed for a 22,000-lb load on a single-wheel gear with 100-psi tire pressure. Pavements consisted of both asphaltic concrete and portland cement concrete. A complete construction history is shown in table 1. A layout of the airfield pavements is shown in plate 1. Typical pavement sections are shown in plate 2.

Traffic history

8. Detailed traffic records were not available. It was reported that the majority of traffic on the pavements is by light (less than 10,000-lb gross load) Army aircraft. The field receives about one C-130 operation a week and periodic operations by C-118 and C-131 aircraft.

Maintenance

9. Maintenance has consisted of patching areas on the original E-W runway that have rutted and failed and placement of a sand seal over most of the other facilities. In 1968 a sand seal was placed on the crosswind runway, the asphalt portion of the west connecting taxiway, and the taxiway to the security area. In 1969 the primary runway and east connecting taxiway received a sand seal. The sand-seal materials consisted of from 0.20 to 0.25 gal per sq yd of RS-3 bitumen with 20 to 25 lb of sand per sq yd for cover aggregate.

Condition of pavement surface

10. A visual inspection of the pavements in September 1970 indicated the pavement condition to range from poor to excellent. The sand seal placed on the primary runway in 1969 appeared to be in good condition on both the runway and shoulder areas (photographs 1-3). There was no evidence of any scuffing of the sand seal where aircraft had made 180-deg turns on the runway. There were two areas on the runway that contained birdbaths (photographs 2 and 4) and a depression from a drainage structure about midway of the runway. There was evidence of a few areas of longitudinal shrinkage cracking, but in general the runway condition was considered good. The surface of the crosswind runway, which was sand sealed in 1968, was considered to be in good

condition. The shoulders on this runway had not received a sand-seal treatment. The taxiway to the security area was sand sealed in 1968 and was in the same general condition as the crosswind runway. The portland cement concrete areas on the east and west connecting taxiways were in excellent condition. The portland cement concrete on the apron area was in poor condition. A considerable number of the slabs contained structural cracking from overload. The original E-W runway was in fair-to-poor condition (photograph 5). Evidence of distress in the form of cracking and deterioration of the pavement surface along the center line of the runway where aircraft taxi was observed. This area is used as a parking area when needed. Continued use will cause further distress in the pavement surface; however, the life of the pavement could be extended by moving the taxiing lane off the center line. The flexible pavement portion of the east connecting taxiway was sand sealed in 1969 and appeared to be in excellent condition (photograph 6).

Evaluation

11. The last evaluation of the load-carrying capacity of the airfield pavements at LAAF was made in 1959 as indicated in paragraph 4b. This evaluation included the E-W runway, north apron taxiway, and runway. No previous evaluation has been made of the facilities constructed in 1961. The physical property data, such as thicknesses of pavement base, and subbase, and select borrow and strength of these layers (CBR, flexural strength, and subgrade modulus k), were obtained from construction drawings and reports referenced in paragraphs 4b and c. The following is a discussion of the materials used in the 1961 construction. This information was obtained from the Materials Investigation Report, and assigned thicknesses and strength values used for design are indicated. Plates 3, 4, and 5 were reprinted from the Materials Investigation Report.

Stabilized aggregate base course

12. The material used for the base course was obtained from a source known as Laundry Ridge located in Huachuca Canyon. Laboratory tests (plate 3)

indicate the material classifies as a silty sand gravel (GW-GM) having a plasticity index of zero. A CBR value of 80 was assigned this material for design and evaluation purposes.

Subbase material

14. The subbase material, obtained from the same source as the base material, was graded and blended to meet the following gradation requirements: 100 percent passing a 2-in. screen, 30 to 75 percent passing a No. 4 sieve, and 5 to 15 percent passing a No. 200 sieve. The plasticity index was specified to be less than 5. A CBR value of 35 was assigned this material for design and evaluation.

Select borrow

15. The select borrow was a disintegrated granite obtained from the Canelo pit. Specification gradation requirements for the material were: 100 percent passing a 2-in. sieve and 5 to 40 percent passing a No. 200 sieve. The specifications also required that the plasticity index not exceed 12. Results of laboratory tests of the material are shown in plate 4. A CBR value of 15 was assigned this material for design and evaluation.

Subgrade

16. The native subgrade soil classifies as a clayey sand (SC) having a plasticity index of about 13. Results of laboratory tests on the material are shown in plate 5. Previous tests for evaluation performed by the WES and reported in the reference listed in paragraph 4b assigned a CBR of 10 for the subgrade soils investigated. A CBR value of 8 was assigned the subgrade soils for design in the 1961 construction, and the value of 8 was also used for this evaluation.

Portland cement concrete

17. The aggregate used for the portland cement concrete was also obtained from the Laundry Ridge source. A 90-day flexural strength value of 660 psi and a subgrade modulus of 200 lb per sq in. per in. were adopted for design and were also assigned for use in evaluation.

Basic field evaluation

18. The load-carrying capacity of the pavements at LAAF is shown in table 2. As noted, the basic field evaluation is controlled by the carrying

capacity of the rigid pavement on the east and west apron taxiway. Occasional use of the pavement facilities by aircraft having gross weights greater than those used for the basic evaluation may be necessary. Table 3 shows the allowable loading of such aircraft operating at frequencies of one cycle per day, one cycle per week, and one cycle per month.

Table 1

Construction History

Facility	Dimensions Length ft	Dimensions Width ft	Surface Thickness in.	Surface Type	Construction Year	Construction Agency	Remarks
E-W runway	5312	150	2	Asphalt conc	1952	Engr troops	
N apron taxiway	670	75	2	Asphalt conc	1952	Engr troops	
Original apron	600	200	8	Portland conc	1952	Engr troops	
Apron extension	750	200	10	Portland conc	1957	USCE	
Primary runway	5365	100	2	Asphalt conc	1961	USCE	
Crosswind runway	4300	75	2	Asphalt conc	1961	USCE	
W apron taxiway							
Flexible portion	230	50	2	Asphalt conc	1961	USCE	
Rigid portion	1070	50	8	Portland conc	1961	USCE	
E apron taxiway							
Rigid portion	175	50	8	Portland conc	1961	USCE	
Flexible portion	900±	50	2	Asphalt conc	1961	USCE	
E connecting taxiway	3094	50	2	Asphalt conc	1961	USCE	Reconstructed 2050 ft of E-W runway
Taxiway to security area	2200±	50	2	Asphalt conc	1961	USCE	

Table 2

Summary of Basic Evaluation

Facility	Allowable Gross Aircraft Loadings in Pounds				Remarks
	Normal Period Operation		Frost Melting Period Operation		
	Single-Wheel Gear	Twin-Wheel Gear	Single-Wheel Gear	Twin-Wheel Gear	
Primary runway			Not applicable		
First 500-ft ends	50,000+	50,000+			
Interior portion	50,000+	50,000+			
Crosswind runway	50,000+	50,000+	Not applicable		
Taxiway to security area	50,000+	50,000+			
West apron taxiway - flexible portion	50,000+	50,000+			
East apron taxiway - flexible portion	50,000+	50,000+			
East connecting taxiway - sta 132+60-163+54	50,000+	50,000+			
North apron taxiway	50,000+	50,000+	Not applicable		
West apron taxiway - sta 105+50-116+20.5	48,000	50,000+	Not applicable		Basic field evaluation
East apron taxiway - sta 129+70.5-131+45.5	48,000	50,000+			
Apron			Not applicable		
Original	50,000+	50,000+			
Extension	50,000+	50,000+			

Table 3

Summary of Pavement Evaluation for Overload Aircraft

(Basic field evaluation: 48,000-lb gross wt for single wheel and 50,000+-lb gross wt for twin wheel)

Overload Aircraft			Allowable Gross Aircraft Load, lb		
	Weight, lb		One Cycle	One Cycle	One Cycle
Type Aircraft	Empty	Gross	Per Day	Per Week	Per Month
C-123	30,000	60,000	55,000		
C-131	30,700	60,000			
C-119	41,000	77,000	60,000	65,000	70,000
C-54	39,000	82,500	60,000		
C-130	69,837	155,000	130,000	140,000	145,000
C-124	100,700	216,000	130,000	135,000	140,000
C-141	134,000	316,600	215,000	260,000	
C-5A	318,200	770,000	595,000	735,000	

55,000 Aircraft can operate at indicated gross load.

Aircraft can operate at maximum gross load.

Photograph 1. View to northwest near southeast end of primary runway

Photograph 2. View to northwest near center of primary runway. Note the birdbath near right edge of runway

Photograph 3. Sand seal on surface of shoulder area along primary runway

Photograph 4. Birdbath near southeast end of primary runway

Photograph 5. Original E-W runway now used for aircraft parking

Photograph 6. Condition of pavement surface on east connecting taxiway near intersection with primary runway

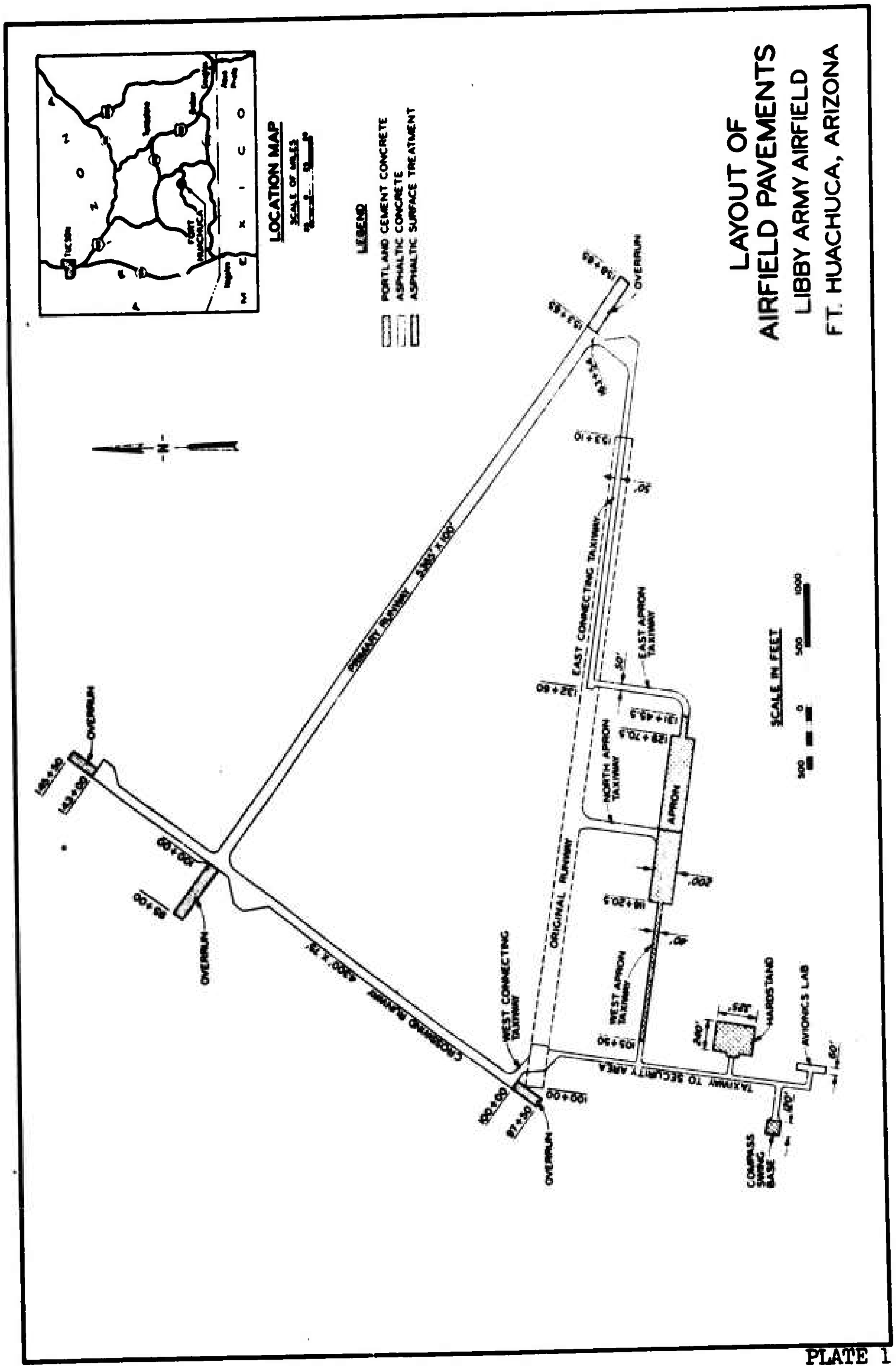
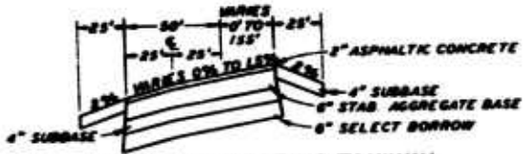

LAYOUT OF
AIRFIELD PAVEMENTS
LIBBY ARMY AIRFIELD
FT. HUACHUCA, ARIZONA
LOCATION MAP
SCALE OF MILES
TUCSON
FORT HUACHUCA
LEGEND
PORTLAND CEMENT CONCRETE
ASPHALTIC CONCRETE
ASPHALTIC SURFACE TREATMENT
SCALE IN FEET
PRIMARY RUNWAY
CROSSWIND RUNWAY
OVERRUN
EAST CONNECTING TAXIWAY
EAST APRON TAXIWAY
NORTH APRON TAXIWAY
APRON
ORIGINAL RUNWAY
WEST CONNECTING TAXIWAY
WEST APRON TAXIWAY
HARDSTAND
AVIONICS LAB
TAXIWAY TO SECURITY AREA
COMPASS SWING BASE

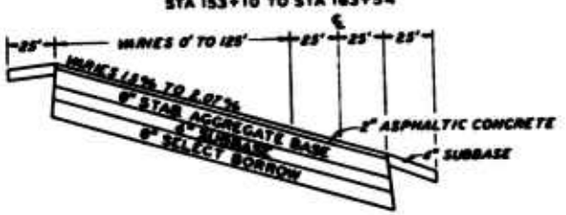
PLATE 1

PLATE 2

EAST CONNECTING TAXIWAY
STA 132+80 TO STA 153+10

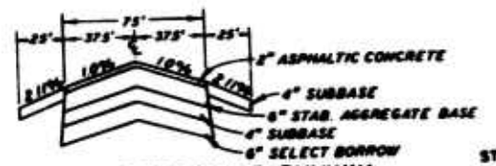


EAST CONNECTING TAXIWAY
STA 153+10 TO STA 183+54

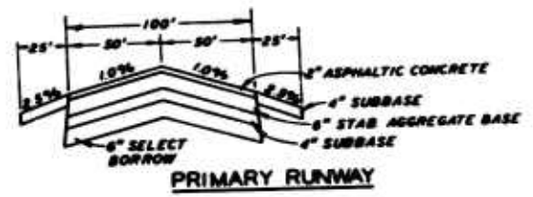


WEST CONNECTING TAXIWAY

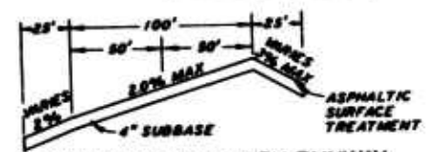
TAXIWAY TO SECURITY AREA,
TAXIWAY TO HARDSTAND,
TAXIWAY TO AVIONICS LAB,
AND FLEXIBLE PORTION -
WEST APRON TAXIWAY



CROSSWIND RUNWAY



PRIMARY RUNWAY

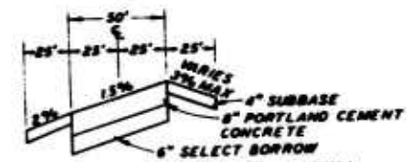


OVERRUNS - PRIMARY RUNWAY
STA 97+50 TO STA 100+00, STA 153+85 TO STA 156+15

HARDSTAND

OVERRUNS - CROSSWIND RUNWAY
STA 97+50 TO STA 100+00, STA 143+00 TO STA 145+50

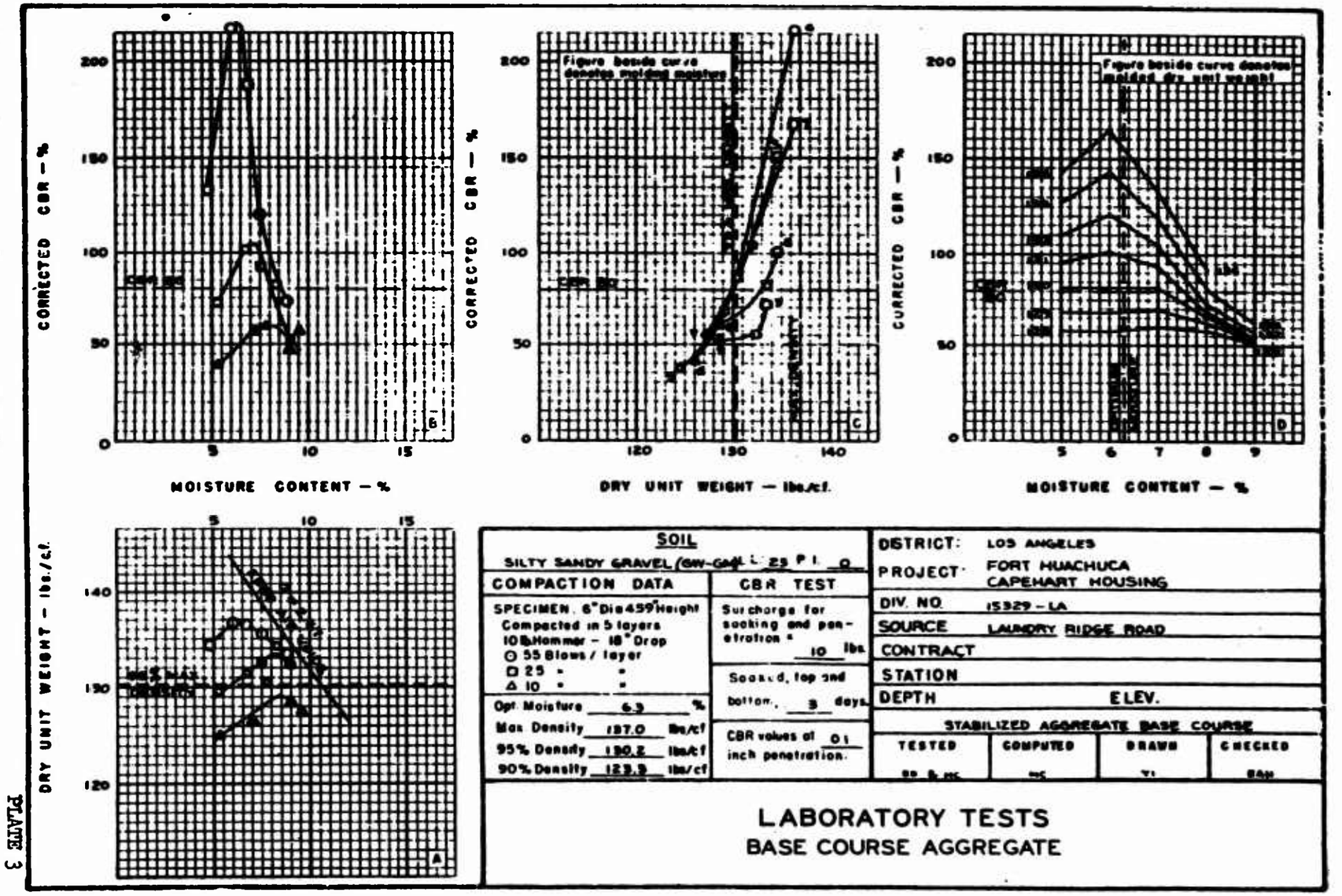
WEST APRON TAXIWAY
STA 105+50 TO STA 118+205



EAST APRON TAXIWAY
STA 129+70.5 TO STA 131+45.5

APRON

TYPICAL PAVEMENT AND FOUNDATION SECTIONS
LIBBY army AIRFIELD
FT. HUACHUCA, ARIZONA



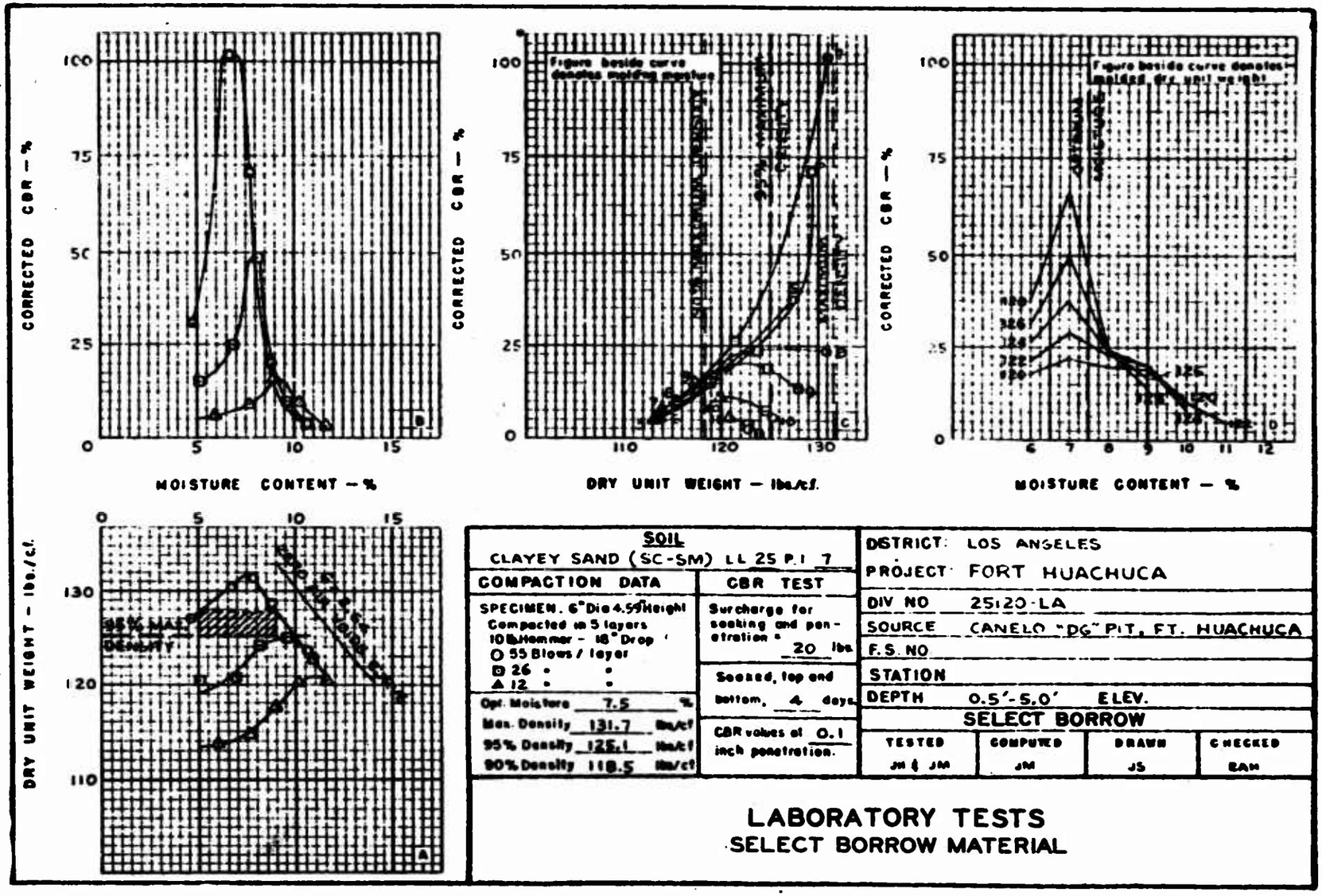
SOIL		DISTRICT: LOS ANGELES
SILTY SANDY GRAVEL (GW-GM) L.L. 25 P.I. 0		PROJECT: FORT HUACHUCA CAPEHART HOUSING
COMPACTION DATA	CBR TEST	DIV. NO. 15329 - LA
SPECIMEN. 6" Dia 4.59" Height Compacted in 5 layers 10 lb. Hammer — 18" Drop ○ 55 Blows / layer □ 25 " " △ 10 " "	Surcharge for soaking and penetration = 10 lbs. Soaked, top and bottom, 3 days. CBR values at 0.1 inch penetration.	SOURCE LAUNDRY RIDGE ROAD CONTRACT STATION DEPTH ELEV.
Opt. Moisture 6.3 % Max. Density 137.0 lbs/cf 95% Density 130.2 lbs/cf 90% Density 123.3 lbs/cf		STABILIZED AGGREGATE BASE COURSE
		TESTED: RP & MC; COMPUTED: MC; DRAWN: TI; CHECKED: BAH

LABORATORY TESTS
BASE COURSE AGGREGATE

PLATE 3

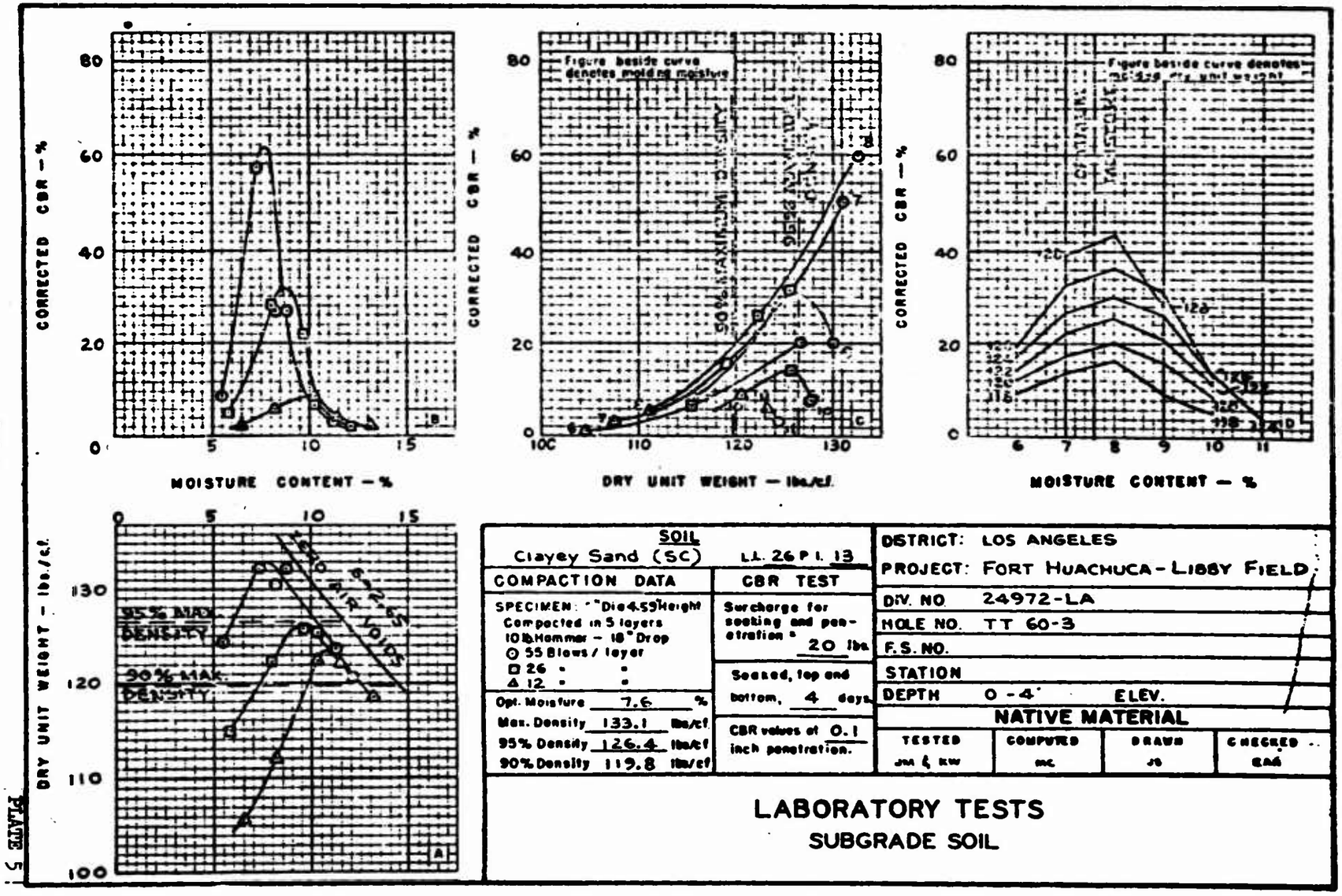
015

PLATE 11



SOIL		DISTRICT: LOS ANGELES
CLAYEY SAND (SC-SM) LL 25 P.I 7		PROJECT: FORT HUACHUCA
COMPACTION DATA	**CBR TEST**	DIV NO 25:20-LA
SPECIMEN. 6" Dia 4.59" Height Compacted in 5 layers 10 lb. Hammer – 18" Drop ○ 55 Blows / layer □ 26 " " △ 12 " "	Surcharge for soaking and penetration = 20 lbs. Soaked, top and bottom, 4 days. CBR values at 0.1 inch penetration.	SOURCE CANELO "DG" PIT, FT. HUACHUCA F.S. NO STATION DEPTH 0.5'-5.0' ELEV. **SELECT BORROW**
Opt. Moisture 7.5 % Max. Density 131.7 lbs/c.f 95% Density 125.1 lbs/c.f 90% Density 118.5 lbs/c.f		TESTED JM & JM · COMPUTED JM · DRAWN JS · CHECKED RAH

LABORATORY TESTS
SELECT BORROW MATERIAL



SOIL	L.L. 26 P.I. 13	DISTRICT: LOS ANGELES
Clayey Sand (SC)		PROJECT: FORT HUACHUCA - LIBBY FIELD
COMPACTION DATA	**CBR TEST**	DIV. NO. 24972-LA
SPECIMEN: 6" Dia 4.59" Height Compacted in 5 layers 10 lb. Hammer — 18" Drop ○ 55 Blows / layer □ 26 " " △ 12 " "	Surcharge for seating and penetration = 20 lbs.	HOLE NO. TT 60-3
	Soaked, top and bottom, 4 days.	F.S. NO.
		STATION
		DEPTH 0 - 4' ELEV.
Opt. Moisture 7.6 %		NATIVE MATERIAL
Max. Density 133.1 lbs/cf	CBR values at 0.1 inch penetration.	
95% Density 126.4 lbs/cf		
90% Density 119.8 lbs/cf		

TESTED	COMPUTED	DRAWN	CHECKED
JM & KW	MC	JS	RAS

LABORATORY TESTS
SUBGRADE SOIL

PLATE 5

017